



MEMORANDUM

TO: Patrick Goddard, Director of Facilities, Town of Lexington
Paul B. Ash, Ph.D., Superintendent, Lexington Public Schools

FROM: Matt A. Fragala, M.S., C.I.H., Senior Scientist
David L. MacIntosh, Sc.D., C.I.H., Chief Science Officer

DATE: January 16, 2014

RE: Report on Indoor Air Samples Collected on December 21, 2013, at Estabrook Elementary School, Lexington, Massachusetts (EH&E 19062)

Environmental Health & Engineering, Inc. (EH&E) provides this memorandum that describes the monitoring for polychlorinated biphenyls (PCBs) in indoor air of Estabrook Elementary School (Estabrook) conducted on December 21, 2013.

SUMMARY OF FINDINGS

- The average PCB concentration for the most recent round of air sampling was 86 nanograms per cubic meter (ng/m^3) with a maximum concentration of $139 \text{ ng}/\text{m}^3$.
- The sampling results do not alter the estimated school year average range of 115 to $125 \text{ ng}/\text{m}^3$ presented in the August 29, 2011, memorandum.
- PCB concentrations in indoor air were not above the threshold for follow-up assessment ($173 \text{ ng}/\text{m}^3$) in any locations. The average ambient temperature during the sampling period was 51 degrees Fahrenheit ($^{\circ}\text{F}$) and temperature appears to be an important determinant of PCB concentrations in the indoor air of Estabrook.
- The duplicate sample collected in Room 4 indicated a concentration of $139 \text{ ng}/\text{m}^3$, which agreed well (3% relative percent difference) with the concentration of $135 \text{ ng}/\text{m}^3$ indicated by the primary sample. The duplicate sample serves a quality control function for precision of indoor air measurements made for the project.

- Ongoing inspections by both the Town of Lexington and EH&E personnel confirm that outdoor air ventilation in all rooms has remained consistent with specifications set forth in the Estabrook Operations and Maintenance (O&M) Plan.

BACKGROUND

As part of the O&M Plan, multiple rounds of air sampling have been completed at Estabrook. The objective of the air testing program is to evaluate PCB levels in indoor air of classrooms relative to performance criteria established in the O&M Plan. The O&M Plan developed for Estabrook states that potential exposure to airborne PCBs shall be controlled to as low as reasonably achievable, and in all locations the annual average concentrations shall be less than 230 ng/m^3 , the target established based on classrooms for children less than 6 years old. Also, a single measured concentration greater than 75% of the annual average target will initiate a follow-up assessment to determine the conditions contributing to the levels of PCBs in the air in that location. On October 7, 2011, EH&E issued a memorandum with a sampling schedule for the 2011 – 2012 school year based on suggestions from the Estabrook community and the Town of Lexington. This sampling schedule is also being implemented for the 2012 – 2013 school year.

CONDITIONS DURING SAMPLING

Mechanical systems in Estabrook were operated in accordance with the O&M Plan. All indoor air sampling was conducted with windows and doors closed. Air samples were collected from approximately 8:00 a.m. – 4:00 p.m. on Saturday, December 21, 2013. The average ambient temperature during the sampling period was 51°F . The thermostat in each room was set to 68°F .

AIR SAMPLE RESULTS

As shown in Table 1 (refer to attachment), PCB concentrations in indoor air of the rooms tested on December 21, ranged from 52 ng/m^3 to 139 ng/m^3 . In Room 4 a sample and one duplicate were collected with measured concentrations of 135 ng/m^3 and 139 ng/m^3 , and a room average concentration of 137 ng/m^3 . PCB concentrations in all of the sampling locations were less than 173 ng/m^3 , the threshold for follow-up assessment.

The plot in Figure 1 demonstrates the relationship between PCB concentrations in indoor air of Estabrook and ambient temperature for the period of November 4, 2010 – December 21, 2013. The average value for December 21, 2013, is plotted in red. These observations suggest that with mitigation measures in place and standardized ventilation rates, variation in temperature appears to be an important determinant of PCB concentrations in indoor air of Estabrook.

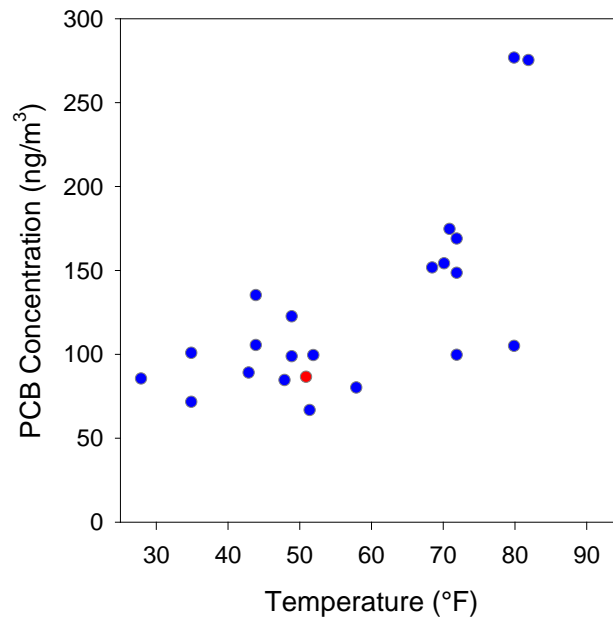


Figure 1 Average Indoor Air PCB Concentrations at Estabrook Elementary School Compared to Average Ambient Temperature during the Sampling Period (November 4, 2010 – December 21, 2013)

If you have any questions regarding this memorandum please do not hesitate to contact us at 1-800-TALK EHE (1-800-825-5343).

Attachment: Air Sample Results

ATTACHMENT
AIR SAMPLE RESULTS

Table 1 Air Sample Results for Total Polychlorinated Biphenyls, Estabrook Elementary School, 117 Grove Street, Lexington, Massachusetts, July 22, 2010 – December 21, 2013*																												
Sample Date	2010												2011								2012				2013			
	Jul 22 ^a	Aug 25 – 27 ^b	Sept 6 ^c	Sept 19 ^d	Sept 27 ^e	Sept 29 ^f	Oct 18 and 19 ^g	Nov 4 ^h	Nov 11 ⁱ	Nov 20 ^j	Nov 24 ^k	Dec 2 ^l	Feb 23 ^m	Apr 20 and 21 ⁿ	May 21 ^o	June 9 ^p	July 13 ^q	July 14 ^r	Oct 7 ^s	Dec 29 ^t	Apr 17 ^u	June 27 ^v	Oct 20 ^w	Dec 27 ^x	Apr 19 ^y	June 27 ^z	Oct 26 ^{aa}	Dec 21 ^{bb}
Location	Total PCBs (ng/m ³)																											
Room 1	299	426	118 [†]	63 [†]	76 [†]	153 [†]	145	–	116	–	–	–	146	–	–	–	–	–	–	60	–	141	–	93	–	118	–	80
Room 2	–	775	455	189	166	253 [†]	53	–	60	–	–	–	–	136	–	–	312	43	100	–	85	–	145	–	159	–	94	–
Room 3	–	–	–	–	–	364 [†]	111	–	110	–	–	–	–	44	–	–	–	–	–	85	–	124	–	144	–	200	–	124
Room 4	–	–	–	–	–	344 [†]	126	105	–	–	–	–	–	–	217	152	348 ^{**AF}	237 ^{AF}	114	–	120 ^{**}	–	212	150	257	348	87 ^{**}	137 ^{**}
Room 5	459	736	320	196	149	209 [†]	79 ^{**}	–	128	–	–	–	–	–	103	–	–	–	–	59	–	126	–	93	–	120	–	68
Room 6	1,800	764	483	171	213	383 [†]	182	131 ^{**}	–	–	–	–	97	–	–	–	9 ^{WO}	163 ^{WO}	–	76	–	266	–	98	188	232	79	85
Room 7A	–	–	5.19	–	–	–	–	–	–	–	34	–	–	15	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Room 7B	–	–	–	–	–	–	–	–	–	–	<5.3	–	–	57	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Room 7C	–	–	–	–	–	–	–	–	–	–	–	–	13 ^{**}	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Room 11	–	–	–	–	–	–	–	–	65	–	–	–	–	–	153	–	–	–	–	43 ^{**}	–	127	–	61	–	78 ^{**}	–	52
Room 13	319	340	184	155 [†]	–	–	–	–	92 ^{**}	–	–	–	94	–	–	–	–	–	57	–	88	–	88	–	106	–	44	–
Room 19	–	–	–	–	–	–	–	–	12	–	–	–	–	–	132	–	–	–	–	43	–	131	–	90	–	102	–	73
Room 20	–	–	–	–	–	–	–	–	–	57	–	–	–	167 ^{**}	–	–	515 ^{AF}	244 ^{AF}	80	–	92	–	156 ^{**}	109 ^{**}	173	146	105	–
Room 21A	–	–	410	193	–	–	–	–	–	–	–	109	103	–	–	–	–	–	79	–	183	–	134	–	136	–	53	–
Room 21B	–	–	–	–	–	–	–	–	–	188	–	–	–	–	566	594 ^{**}	–	–	66	–	186	–	176	100	144	–	52	–
Room 22	–	–	–	–	–	–	–	–	–	25	–	–	–	–	224 ^{**}	291	337	177	–	70	–	221	–	89	207	186	–	75
Room 23	–	–	–	–	–	–	–	–	–	142	–	–	–	93 ^{**}	–	–	–	–	–	55	–	135	–	76	–	55	–	64
Room 24	680	601	226	173 [†]	–	–	–	–	–	106 ^{**}	–	–	86	–	–	–	233 ^{WO}	116 ^{WO}	52	78	80	238	151	–	205 ^{**}	69	58	–
Room 25	–	–	–	–	–	–	–	–	–	130	–	–	–	135	–	–	–	–	–	–	–	–	201	91	–	103	–	54
Room 26	–	–	–	79	–	–	–	–	–	–	47	–	–	–	58	–	–	–	–	–	–	–	–	–	–	–	–	–
Room 27	–	–	–	–	–	–	–	–	–	–	69	–	–	–	15	–	–	–	–	–	–	–	–	–	–	–	–	–
Room 31A	562	575	444	–	–	282	–	–	–	94	–	–	–	97	–	–	175	78	75	11	97	–	112	–	132	–	60	–
Room 31B	–	–	–	–	–	–	–	–	–	135	–	–	–	52	–	–	202 ^{WO}	65 ^{WO}	–	–	–	172 ^{**}	–	88	–	126	–	81
Room 39B	–	419	–	–	–	–	–	–	–	64	–	–	–	–	132	–	179 ^{AF}	45 ^{AF}	66	52	80	–	102	–	85	–	48	–
Room 39C	342	495	245	100	–	–	–	–	–	125	–	–	76	–	–	–	–	–	–	–	–	158	–	83	–	98	–	58
Library	–	469	196	–	–	–	–	–	–	–	135	–	–	–	208	386	263 ^{WO}	176 ^{WO}	87 ^{**}	–	–	–	124	–	–	–	27	–
Art/Music Room	–	–	194	–	–	–	–	–	–	–	–	30	–	61	–	–	–	–	–	–	17	–	–	–	65	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–	–	–	–	–	–	–	–	–	–	–
Administrative Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–	–	–	–	–	–	–	–	–	–	–
Teacher Work Room	–	–	138	–	–	–	–	–	–	–	34	–	–	–	164	–	–	–	–	–	–	–	–	–	–	–	–	–
Administrative Offices	–	–	–	–	–	–	–	–	–	–	72	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Sanborn Office	–	–	–	–	–	–	–	–	–	–	–	66	–	55	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Teacher Lounge	–	–	–	–	–	–	–	–	–	89	–	–	–	–	117	–	–	–	–	–	–	–	–	–	–	–	–	–
Basement	–	–	227	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	78	–	–	–	–	–	–	–	–
Ceiling plenum (39C)	–	–	–	562	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gym	–	–	–	–	–	–	–	–	–	–	–	38	–	29	–	–	–	–	–	–	–	80	–	–	–	75	–	–
Sped Office	–	–	–	–	–	–	–	–	–	–	–	134	–	86	125	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 1 Continued																												
Sample Date	2010												2011								2012				2013			
	Jul 22 ^a	Aug 25 – 27 ^b	Sept 6 ^c	Sept 19 ^d	Sept 27 ^e	Sept 29 ^f	Oct 18 and 19 ^g	Nov 4 ^h	Nov 11 ⁱ	Nov 20 ^j	Nov 24 ^k	Dec 2 ^l	Feb 23 ^m	Apr 20 and 21 ⁿ	May 21 ^o	June 9 ^p	July 13 ^q	July 14 ^r	Oct 7 ^s	Dec 29 ^t	Apr 17 ^u	June 27 ^v	Oct 20 ^w	Dec 27 ^x	Apr 19 ^y	June 27 ^z	Oct 26 ^{aa}	Dec 21 ^{bb}
Location	Total PCBs (ng/m ³)																											
Room B	–	–	–	–	–	–	–	–	–	–	–	148	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Kitchen	–	–	–	–	–	–	–	–	–	–	–	66	–	24	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Room D	–	–	–	–	–	–	–	–	–	–	–	108	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hall Office (o/s Art)	–	–	–	–	–	–	–	–	–	–	–	125	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Worker	–	–	–	–	–	–	–	–	–	–	–	–	–	<4.99	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Room C	–	–	–	–	–	–	–	–	–	–	–	–	–	–	137	–	–	–	–	–	–	–	–	–	–	–	–	–
Outdoors	<3.79	<5.00	<4.20	<4.46	<4.32	<4.44	<5.54	<4.58	<4.60	<4.08	<5.32	<5.95	<4.37	<5.31	4.38	<5.41	<4.99	<4.67	<10.4	<7.2	<8.0	<7.25	<8.0	<7.96	<7.87	<7.40	<8.01	<7.21
<div> <div>PCB</div> <div>ng/m³</div> <div>–</div> <div>polychlorinated biphenyl</div> <div>nanograms per cubic meter</div> <div>air sample not collected at that location</div> </div> <div> <div>^a</div> <div>Initial round of sampling</div> </div> <div> <div>^b</div> <div>Samples collected following removal of caulk around exterior window frame</div> </div> <div> <div>^c</div> <div>Samples collected following initial optimization of outdoor air delivery and central exhaust, unless otherwise noted.</div> </div> <div> <div>^d</div> <div>Samples collected under optimization of outdoor air delivery and central exhaust, and indoor caulk encapsulation, unless otherwise noted.</div> </div> <div> <div>^e</div> <div>Samples collected under optimization of outdoor air delivery and central exhaust, partial indoor caulk encapsulation, and isolation of ceiling tiles.</div> </div> <div> <div>^f</div> <div>Samples collected under reduced outdoor air delivery, central exhaust, full indoor caulk encapsulation, and isolation of ceiling tiles.</div> </div> <div> <div>^g</div> <div>Samples collected under isolation, encapsulation and air cleaner configurations.</div> </div> <div> <div>^h</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>ⁱ</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>^j</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>^k</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>^l</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>^m</div> <div>Samples collected under winter outdoor air delivery, mini-wall, and full indoor caulk encapsulation.</div> </div> <div> <div>ⁿ</div> <div>Samples collected under winter outdoor air delivery (70 °F set point), mini-wall, and full indoor caulk encapsulation. Windows closed.</div> </div> <div> <div>^o</div> <div>Samples collected under summer outdoor air delivery (70 °F set point, exhaust on at 8:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.</div> </div> <div> <div>^p</div> <div>Samples collected under summer outdoor air delivery (63 °F set point, exhaust on at 6:00 a.m.), mini-wall, and full indoor caulk encapsulation. Windows closed.</div> </div> <div> <div>^q</div> <div>Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.</div> </div> <div> <div>^r</div> <div>Samples collected under summer outdoor air delivery (63 °F set point, unit vents and exhaust on 24/7 as described in 8.29.11 Memo), mini-wall, and full indoor caulk encapsulation. Windows closed unless noted.</div> </div> <div> <div>^s</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^t</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^u</div> <div>Samples collected under summer outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^v</div> <div>Samples collected under summer outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^w</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^x</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^y</div> <div>Samples collected under summer outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^z</div> <div>Samples collected under summer outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^{aa}</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>^{bb}</div> <div>Samples collected under winter outdoor air delivery (68 °F set point, unit vents and exhaust on). Windows and doors closed.</div> </div> <div> <div>[*]</div> <div>PCB concentration analysis performed by Alpha Analytical Inc., using U.S. Environmental Protection Agency (EPA) Method 10A (GC/MS-SIM).</div> </div> <div> <div>^{**}</div> <div>Average of sample and sample duplicate results</div> </div> <div> <div>[†]</div> <div>Samples collected under minimum outdoor air delivery.</div> </div> <div> <div>[‡]</div> <div>Sample collected with supplemental air outdoor air (1,200 cubic feet per minute).</div> </div> <div> <div>^{AF}</div> <div>Sample collected with charcoal air filter running in the classroom.</div> </div> <div> <div>^{WO}</div> <div>Sample collected with classroom windows and doors open.</div> </div>																												